Improving productivity of the sole and intercropped pigeonpea and soybean through phosphorus fertilization under different agro-ecologies of Central Malawi

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Abstract

Pigeonpea and soybean are important grain legumes with increased local level consumption by rural households in Malawi. In addition, integration of the two legumes in maize based systems is one of the strategies to improve nitrogen (N) economy and yields as legumes fix the abundant atmospheric N to a plant usable form, thereby improving the productivity of maize, a staple food crop in Malawi. A study was conducted during the 2013/2014 growing season at three sites in central Malawi with the objective of determining grain yields and biological N^2-fixation of the sole and intercropped pigeonpea and soybean under two levels of inorganic P (0 and 14 kg P ha^{-1}). We used both the N difference and ^{15}N natural abundance methods to estimate BNF contribution. The experiment was laid out in a randomized complete block design (RCBD). Soybean grain yields and BNF in sole stand were 1280 and 54 kg ha^{-1}, respectively, while pigeonpea grain yields and BNF in sole stand were 840 and 65 kg ha^{-1}, respectively. Intercropping reduced pigeonpea grain yields and BNF by 47 and 38.5% respectively, but had no effect on soybean grain yields and BNF. The intercrop system had better utilization of resources with a land equivalent ratio of 1.44. The soybean + pigeonpea intercrop fixed 90 kg N ha^{-1} which was 67 and 38% higher than that fixed by the sole crop systems of soybean and pigeonpea. At two of the sites, P fertilization increased soybean grain yields from 1471 to 1831 and from 1111 to 1340 kg ha^{-1}. Similarly, phosphorus fertilization increased soybean BNF from 60-71 and from 44-53 kg ha^{-1} at the same sites. No significant improvements in soybean grain yields and BNF were obtained with phosphorus fertilization at the driest site. Intercropping of soybean and pigeonpea and application of P in suitable agro-ecologies offers good option for improved grain yields and soil fertility through increased BNF, that in turn could improve nutritional status and income for the rural communities.